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The plan includes a (somewhat obsolete) system of classification, a chapter on geological history, one on distribution (such as can be obtained from existing manuals), on reproduction (omitting reproductive acts), on food, evolution, instinct, intelligence and uses, with an index.

Taken for what it is, a compilation from the literature for popular use, it should not be too harshly criticized, and in fact presents a useful compendium of widely scattered data, not elsewhere brought together.

It is well illustrated, chiefly by reproduction of the plates of the well-known "Manual of the Mollusca," by S. P. Woodward, first published in 1850, and in its time easily the best of the smaller manuals of the mollusca.

Taking into consideration the purpose of the book, the chief criticism which in justice to the reader we feel should not be suppressed, touches on the too ready acceptance by the author of some statements by others which stand in desperate need of confirmation.

For instance the assertion that the murices utilize the spur or projecting spine of the aperture of the shell to pry open bivalves which they intend to devour, is almost precisely on a level with the statement that a man can sit in his own lap, and would be possible only in space of the fourth dimension. In the most charitable view the author of this assertion united to a lively imagination very imperfect observation. Such notions touch the imagination of the ignorant, but have no proper place in scientific literature.

Also the assertion that the shell-bearing Pteropoda are derived (p. 56) from the *Bulla*-like Tectibranchs (originating with an anatomist of limited experience with mollusks) is hardly compatible with the ascertained facts that shell-bearing Pteropods occur in the Cambrian; while the Bulloid Tectibranchs first appear near the close of the Carboniferous (p. 47).

Here and there such questionable statements mar the generally high average of accuracy of this little compendium, but, on the whole, it will fulfil a useful purpose.

WM. H. DALL

PRINCIPIA ATMOSPHERICA

1. *Upper Air Calculus and the British Soundings during the International Week* (May 5-10), 1913. By W. N. SHAW. *Journal of the Scottish Meteor. Soc.*, Vol. XVI, No. XXX, p. 167.
2. *Principia Atmospherica*. A Study of the Circulation of the Atmosphere. *Proc. Roy. Soc. Edinburgh*. Read December 1, 1913.
3. *Principia Atmospherica*. An address before the Mathematical Society, January 7, 1914. Privately printed.
4. *The Interpretation of the Results of Soundings with Pilot Balloons*. *Quar. Jour. Roy. Meteor. Soc.*, April, 1914.

In these four recently issued pamphlets, Dr. W. N. Shaw, the progressive director of the British Meteorological Office throws wide open a new door in aerology through which we seem to catch sight of that great desideratum, the forecast based on definite laws, or perhaps it would be the part of wisdom to say, definite foreknowledge of the structure and energy distribution in "highs" and "lows" in connection with the flow of air at different levels.

It is only a short time since W. H. Dines, studying numerous upper air observations, came to the conclusion that the differences of pressure at the earth's surface were of the same order of magnitude as those at a height of nine kilometers and therefore the distribution must be regarded as controlled by conditions at the base of the stratosphere. In studying this remarkable result, Shaw examined the physical conditions necessary for the building up of pressure between points at the same level in two verticals and found that the difference in the influence of the stratosphere and troposphere is attributable to the characteristic difference of temperature. He establishes a formula for the increase of pressure difference per meter of height and a second equation which gives the gradient wind velocity at any level. This latter is used to explain the variation of wind velocity with height and in particular the falling-off in velocity in

the stratosphere. In the second paper Shaw carries the application of the equations somewhat further and making certain assumptions works out temperature and pressure from wind velocity at successive heights. There is also a statement of certain axioms or laws of motion and applications of the laws in practical meteorology. The laws stated briefly are (1) relation of motion to pressure; (2) computation of pressure and application of gaseous laws; (3) convection, which is expressed as the descent of colder air in contiguity with air relatively warmer; (4) the limit of convection, defined as that portion of the atmosphere where there exists a sensible fall of temperature with height, and (5) the law of saturation.

The irregular variations in temperature-difference as given by a pair of soundings with registering balloons; and the curious local irregularities of wind disclosed by pilot balloon ascents, hitherto explained as uncertainties of observation, are now in Dr. Shaw's opinion seen to be important as indicating complex structure of the atmosphere. If Shaw's reasoning is correct then it may be possible to get from one pilot balloon as much information for practical purposes as from three registering balloons. The distribution of isobars at 4 kilometers as computed by Teisserenc deBort is also considered and the law of convection applied. One sentence is significant and may be quoted. "All the main air-currents of the globe have pressure-distributions to guide them. They can not usefully be called convection currents." There is also a most suggestive reference to the flow of air down the Arctic and Antarctic slopes. It appears likely that whenever in a mass of air, temperature-fall is in the opposite direction to pressure-fall, great change in the horizontal distribution of pressure underneath is the result; and many of our local variations of pressure may fairly be attributed to the reactions which these cold masses of air offer to the attempt (in the end futile) of the upper air to steer them round the pole from west to east. If left to themselves they would circulate in opposition to the circulation of the upper air with which they are in perpetual conflict.

With regard to tropical revolving storms, Dr. Shaw holds that these must be considered under a different head, namely that of turbulent motion, and intimates that papers are forthcoming on this subject.

The third paper is largely made up of tables for facilitating computation in problems like those referred to above.

In the fourth paper our author deals with examples taken from typical cases of atmospheric structure selected by Mr. Cave for illustration by means of photographs of models in the "Structure of the Atmosphere in Clear Weather." Five distinct classes are considered. He introduces a new conception, that of operative pressure. How this is produced does not appear but if its existence be granted and the thermal structure of the underlying air, then the deductions drawn follow with mathematical precision. Instances of irregular distribution of temperature are explained and in the case of one marked inversion it is imagined that the construction was formed above a pool of cold air such as would be found over fog. The result of recent work is to show that as regards the weather of the present and the immediate future, the operative pressure distribution and the thermal structure of the atmosphere between it and the ground ought to be regarded as independent variables.

Shaw looks forward to the issue of maps of the upper levels wherein cloud observations and pilot balloon data will show what the actual circulation at a given level is. From these we may estimate the effect on pressure distribution in lower levels.

The papers taken together give a working plan so far as general atmospheric motion is concerned and form a distinct contribution to the solution of the problem of the life-history of cyclones and anti-cyclones.

ALEXANDER McADIE

BLUE HILL METEOROLOGICAL OBSERVATORY

NAVIGATION WITHOUT LOGARITHMS¹

CAPTAIN GUYOU, of the French navy, a mathematician of note, author of valuable

¹"Nouvelles Tables De Navigation," Emile Guyou. Berger-Levrault, Editeurs, Paris.